National Policy for leveraging Common Services Centre (CSC) ecosystem for establishing Public Wi-Fi Broadband network

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Abstract
Ubiquitous access to the net connectivity and its impact on the national GDP growth are widely recognized at all level. 'Always On' data connection irrespective of the geographical variations has a greater significance in respect of enabling the users to remain in touch with the competitive world for greater contributions on the emerging market facing technological innovation & digitization for efficiency & inclusion- financial & social both. There has been an increasing demand by individuals and organizations that the high speed uninterrupted data services should be made available at all the time at an affordable & cheaper rate. Presently, contribution of mobile network like 3G/4G for data services has led to a greater benefit to the society. But, due to the rapidly increased mobile data overload fulfillment of users' demands are often compromised at the cost of unwanted network latency leading to declining the satisfaction level of the consumers. It has been a research proven outcome that an wide spread network of **Public Wi-Fi service** can greatly improve this scenario as a complementary service in such a way that mobile data can be dynamically offloaded / shared to get rid of unwanted break in packet transmission. It has been a constant endeavor of the Government to take remedial steps for improving the telecom grade of service (GoS) in accordance with the technological evolution and its consumption for emerging national growth. *The instant article for proposal of research intends to study, explore and suggest policy framework under the aegis of government for Public Wi-Fi Broadband service & accessibility for bringing digital revolution by encouraging developing innovative content & application based seamless citizen service delivery mechanisms under integrated platform supporting all kinds of digital financial services also.*

1. Introduction :: Need for the Policy

Effective planning of socio-economic development processes largely rely on the last mile connectivity. Extending high speed broadband connectivity up to the last mile especially in the Rural & Remote areas by using the license based mobile technology is still a challenge for a large section of TSPs. Involvement of huge investment put the barrier to entry for the ISPs to facilitate the last mile connectivity due to lack of viability & sustainability in terms of return on investment (ROI). Wi-Fi spectrums mostly being the license-exempts can be a driving force to motivate the ISPs to participate in those unconnected areas, in case there is an appropriate Government Policy & Regulatory Processes in place which shall guide as well as protect both the demand & supply sides in a fairly manner. The current regime of Broadband Policy does not enable a neutral & interoperable Public Wi-Fi services & its accessibility. Such regimes need to be revamped to facilitate an efficient Public Wi-Fi network which further necessitate standards & interoperable systems. Hence, *National Public Wi-Fi Broadband Service & accessibility Policy* aims to provide an enabling provision and unified platform for providing a reliable and open access to the high speed data connectivity for the citizens by leveraging various prevailing backbone infrastructures (backhaul) and front-end service delivery ecosystem like CSCs to change the market economy for bringing in greater impact on GDP etc.

2. Summary of findings / recommendations

The principles on which Public Wi-Fi service & accessibility need to be based include the following:

	Recommendations / Findings	Brief Descriptions	Outcome Indicators
1.	**I**nteroperability, compatibility, open standards, scalability, quality of service & flexibility on user portability	Wi-Fi devices & equipments must be interoperable, compatible, quality assured and should follow open international standards to future upgradation.	Ease of adaptability.
2.	**A**ffordability	Connectivity should be non-discriminatory, affordable & uniform by nature across the country.	Common for all.
3	**S**ecured payment structure & encryption of accounting transaction data	A National level integrated & secured platform of Payment Interface supporting multiple ISPs should be adopted.	Secure & Robust payment system

4.	**S**tandardizing **U**ser authentication, secured login & protection of user privacy	-User authentication during registration process should be standardized & independent of any device, ISP and application. It should be a seamless process for all types of users (foreign or domestic). One of suggested method could be Aadhaar for domestic users, and, Passport number or any other method suggested by Ministry of External Affairs (MEA) for foreign users. -Secured login as per DoT instruction dated 23.02.2009. -Protection of user's privacy in terms of information contents and identity should be protected at any cost.	Aadhaar or Passport Central authentication mechanism, ID/ Password in Mobile No./ OTP Proper encryption algorithm.
5.	**U**niform Institutional framework for bringing professionalism at all levels.	For collaborative action under clear cut Administrative & Organization Reforms at State / District/ Panchayat level, as broadband is now a national demand.	Defined Roles & Responsibilities with accountability at all stakeholder levels.
6.	**P**rovision of Data load sharing between prevailing mobile technologies and incumbent Wi-Fi technology through **S**tandardized SLAs between ISPs	For neutral Wi-Fi network for ease of movements by subscribers, there should be automatic switching between different technologies in case of data overload or absence of either of the services.	"Always Connected"
7.	**S**ustainable business model.	Viable & guaranteed revenue sharing business models for ensuring sustainability to both last mile village level entrepreneurs /other capable kiosk operators and ISPs/National CSC content & application provider (CSC SPV)/any other CAPs.	Win-Win situation
8.	**C**onformity to Net-neutrality & right to equal access.	CAPs (Content & Application Providers) should not be differently treated by the ISPs so as to ensure equal access of the Wi-Fi services by the users.	No bread-burger discrimination.
9.	**C**onformity to existing Legal framework	Wi-Fi operation should be in conformity with the existing legal framework of Cyber Security (IT Acts) and Rules & users should be always traceable. As the spectrum is now license-exempt & used by multiple ISPs, a comprehensive legal framework should be structured in such a way so as to ensure proper planning of frequencies against the challenges over scarcity of spectrum.	LI (Lawful Interception) Legal conformity for unhampered operations.
10.	**B**OOT based commercial model for deployment of Public Wi-Fi services	State Governments/UT Administrations need to take ownership of the model after public Wi-Fi network is rolled out	
11.	**C**reation of special purpose vehicle (SPV)- perpetuity in nature for wide implementation & monitoring even after government supports end	For regular assessments on frequency & site planning, monitoring, providing supports at technical & financial capabilities etc. even after Government supports end.	National PMU as an onus for coordinatings entire implementation
12.	**L**everaging existing Common Services Centre (CSC) ecosystem for doing voluminous transactions on specialized services of **Digital**	The CSC Entrepreneurs, called VLEs can also be entrusted to look after the maintenance of Wi-Fi access points and scaling up the distribution of Wi-Fi	Lucrative Business model.

|		services. Rents can be compensated in various ways.	
13.	**R**ight of the way (ROW) for ISPs to set up Wi-Fi hotspots	Civic Body/Local Body to ensure ROW for faster deployment.	Minimum formalities
14.	**J**ustified frequency & site planning to avoid interferences	For widespread penetration of Wi-Fi, allocative efficiency having properly regulated frequency planning is a must, be it license-exempt or licensed,	Fair competition would bring rising & sustainable business models.
15.	**P**ricing mechanism of Wi-Fi spectrum	In case, the Government decides to leverage some more quantities of unused spectrum for Public Wi-Fi service, there can be some possible ways (but not limited to)- Initially license-exempt on trial basis & later on licensed based on market economic scenario.	Minimizing barriers to Entry for ISPs.

3. Regulatory issues, licensing restrictions and way out

Following regulatory issues, licensing restrictions & other factors need to be addressed under a suitable re-engineered & revamped regulatory framework of ICT services to escalate the growth of public Wi-Fi services in India.

▪ Despite the existence of unlicensed spectrum for Wi-Fi in four different operating bands of frequency at present in India, there is a need to address the issues of limitations of their usage, as it would be a real challenge for ISPs to operate on such scarcity of spectrum with limited spot frequencies. For instance, outdoor use of those frequency bands (like 5.725 - 5.825 GHz band) should be allowed by allocating all the possible range of these spectrums free of license.

▪ There are several other frequency bands which can supply high capacity backhaul. For instance, E-Band (80 GHz) and V-Band (40-75 GHz) for short distance application, clear Line of Sight (LOS) & low-rain areas. Other internationally harmonized bands in 6-42 GHz range viz. 26 GHz, 28 GHz, 32 GHz, 38 GHz and 42 GHz.

▪ Government needs to gradually workout to release larger quantities of unlicensed spectrum (as has been done in many parts of the world) for better quality of service and reducing the loads on existing networks. Utilizing TV White Spaces, i.e. unutilised frequency bands (**470-690 MHz UHF**) which were earlier used to prevent channel overlapping during analogue broadcasts of television programming, could be helpful in improving the quality of service with lesser investments on Outdoor Wi-FI Access Point (OPAP) infrastructures to create a wireless backhaul for supporting further development of wireless Internet access, and other experimental technologies. On Pilot basis, Government may explore the technical & financial feasibility of using these unused spectrums.

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▪ While allocating spectrum for Public Wi-Fi, government need to reserve some unlicensed spectrum for public utilities kind of services e.g. e-Governance services, basic utility services and other important inclusion services (for CSCs) etc.

▪ Regulatory measures ensuring that Wi-Fi devices & equipments meet criteria of Interoperability, Compatibility, Open standards, Scalability, Quality assurance & flexibility on user portability must be incorporated.

▪ A suitable government regulatory measure & benchmark needs to be formulated by the regulatory body to address the issue of packet transmission interruption in case of network congestion on mobile networks in high density public footfall areas by mandating automatic handover to the public Wi-Fi networks for mobile traffic offload. TRAI needs to conduct periodical audit on the Wi-Fi operation of various ISPs to check the performance against the interferences and other factors. Government also needs to suitably adopt some measures to incentivize the TSPs/ISPs in terms of liberty on taxation system according to the performance over uninterrupted data service provided to the citizens. ISPs may decide to enter into appropriate SLAs with other ISPs for sharing of public Wi-Fi infrastructure on rental/ revenue share basis. It would also help in resolving interference issues which can come up due to access points of different service providers installed in a location using the same unlicensed ISM band.

▪ With the advent of leveraging usage of larger quantities of unlicensed spectrum, possibility of attributing increased non ionizing EMF radiation may arise. To avoid radiation hazards due to cumulative effect of EMF radiation, Government needs to properly regulate the usage of these bands through suitable recommended control mechanisms like monitoring the EMF Compliance & other standard benchmarks of radio access network etc.

- For uninterrupted Wi-Fi coverage & widespread adoption of Wi-Fi services across various geographical locations, there is a need to work out a definite policy framework by the government with appropriate mechanism that can provide guidance for ubiquitous Wi-Fi services, across service providers. In view of the sluggish progress in adoption of Wi-Fi services in India, a clear cut policy guidelines needs to be formally released for guiding with the right direction towards development of necessary backbone infrastructures called **Wi-Fi Hub/Exchange** (zone-wise/state-wise) with necessary centralized secure payment gateway mechanism which can support standardized & viable business & commercial model at the last mile establishing a Win-Win situation for all the stakeholders & users in terms of sustainability & performance. For this, **creation of national backbone infrastructures for smooth handover & roaming** in the Wi-Fi network & establishing internet exchange are the most significant development areas for which right policy measures are required. Under such activities, also there is a need to further standardize the Wi-Fi transmission network by increasing its performance in terms of radio coverage & bandwidth. In view of the increasingly over crowded band in 2.54/5.8 GHz spectrum, the need has been felt to increase the backhaul capacity by leveraging various underutilized or unused bands of spectrum to meet the demands of crowd. For instance, utilizing unused TV White spaces in UHF/VHF bandwidths can help to a great extent in terms of coverage with low EIRP. The Government should devise a suitable policy with regulatory framework for leveraging such bands in the context of very low growth of Wi-Fi hotspots, which is presently 31,518 only (Globally the increase in number of Wi-Fi hotspots from 2013 to 2016 has been 568% whereas India has an increase of 12% only).

> **Backdrop**

23% Mobile Internet Penetration **9%** Internet Penetration in Rural India **53%** Internet Penetration in Urban India

Increase in Wi Fi hot spots 2013-16 **12%** India **568%** Global

No of Wi-Fi Hot Spots

- India: 0.31
- US: 9.8
- UK: 5.6
- France: 13

■ In millions

Source: IAMAI 2015 & TRAI, Wi-Fi Consultation Paper, July 2016

- There is a need to consume the huge bandwidth of BharatNet point of terminals (PoT) at Gram Panchayat (GP) level up to the level of the absorptive capacity. At present, no such concrete last mile connectivity model is present to further distribute the bandwidth up to the common public. From the various field studies on the ongoing NOFN Pilot project for 59 GPs at three Blocks (Arain, Parvada, Panisagar), it has been ascertained that there is a need of collective actions at all institutional levels (local body & non-govt. organizations) for taking forward the bandwidth to every intended users of internet. Keeping in view of faster deployment with lesser investment & maintenance costs, Wi-Fi solution is expected to play a major role at the last mile. **For this, a demand side analysis for arriving at absorptive capacity of present & potential institutional users need to be assessed under the implementation framework of public Wi-Fi Policy. Thorough research, study & analysis by premier institutes like IITs etc. should be incorporated for a productive implementation.** Also the intention & affordability of the common users need to be kept in mind for arriving at market discovery of pricing for the connectivity as per their differential demands. To have the absolute potential users, there is a need to assess the reasons behind not using the internet (study reveals it is 65% in the NOFN Pilot GPs) which may vary from each other- for instance, lack of awareness in the people about BharatNet, lack of required devices, lack of intentions-can continue existing work without internet etc. All these need to be considered and suitably resolved for proliferating the Wi-Fi.

- With an intend to proliferate the broadband through Wi-Fi by using the BharatNet backhaul, Government may consider to recommend the following:

  -   Outdoor public Wi-Fi access point (OPAP) to be set up in each GP.

  -   Pilot test to establish last mile connectivity models of service delivery which can support various business model.

  -   OPAPs for provision of various citizen centric services at rural level to be implemented through viability gap funding (VGF) by reverse auction in PPP mode. CSC SPV may be involved in assured provision of services (e.g. Content & Application Provider-CAP) through VGF model where first right of refusal would be provided to CSC.

  -   Wi-Fi to be free for initial period of 3 months & 2 GB data. Operation, maintenance & customer interface to be the responsibility of bidder.

  -   Use cable TV network, MSO, LCOs in provision of services through appropriate models.
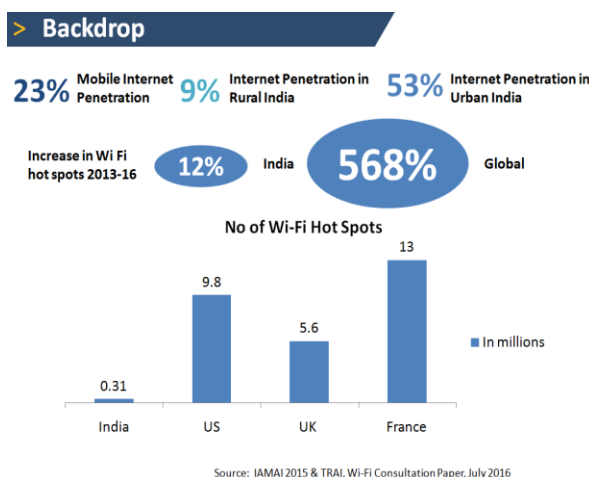
- Involvement of States in implementation and monitoring would be encouraged through appropriate mechanisms. States which complete work before scheduled timeline to be incentivized in funding pattern of BharatNet.
- Single agency such as BBNL to manage fibre from Block to GP level, but last mile service delivery to be done by private operators, by providing non-discriminatory access to the citizens.

In this regard, a typical conceptual business model of 4-layered architectures may be considered:

1. Govt. Universal Platform for centralized eService delivery and various socio-economic development programmes, like MyGov, CSC-Digital Seva etc.: Government to provide access infrastructures, build & deployment cost (through VGF) for expanding the footprints to overcome digital divide and challenges over high cost-less demand etc. For this, a centralized platform needs to be leveraged for integrated service delivery through suitable self-sustainable models with accountability.

2. Operators/ISPs for network operation & maintenance (O&M), marketing & distribution, retailing & customer supports, management of terrestrial backhaul etc.

3. Local business communities / Entrepreneurs for last mile coverage and ease of O&M.

**4. Users** (individual/corporate level)

For instance, Facebook has already been adopting this architecture for Express Wi-Fi.

▪ **Leveraging additional spectrum & suitable pricing mechanism of Wi-FI spectrum can be attributed as the fulcrum for establishing a uniform national public Wi-Fi infrastructure**. In case, the Government decides to leverage some more quantities of unused spectrum for Public Wi-Fi service, there can be following possible ways, but not limited to:

i) Releasing those unused spectrum as license-exempt on Pilot run basis for a definite duration.

ii) Depending upon the performance after implementation phase and also depending upon the level of revenue earning by all the stakeholders, an appropriate market discovery of prices can be adopted to derive the pricing for charging the license fee against release of those unused, but most effective radio frequency spectrums, keeping in view the rational market mechanism, allocative efficiency & prospects of more & more participation of ISPs for developing standard business & commercial models ensuring

the sustainability through the way of partnership, collaboration & convergence of various Wi-Fi servers presently working in silos. Whilst doing so, there should not be any scope for unwanted competition in the market which may narrow the profit margins in the Wi-Fi business.

iii) Market discovery of prices based on different business model of revenue sharing.

iv) Market discovery of prices based on different commercial models of infrastructure set up- either Build Own Operate (BOO), Build Own Operate & Transfer (BOOT) etc.

Proposed Architecture of Operation
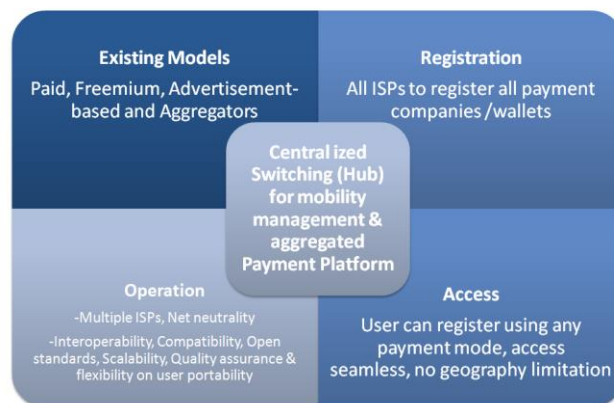
4. Deployment of commercial models

Regulatory/licensing or policy measures are required to encourage the deployment of commercial models for ubiquitous city-wide Wi-Fi networks as well as expansion of Wi-Fi networks in remote or rural areas

For this, Government needs to consider the following recommendations:

- Liberty to ISPs on taxation part until the model becomes viable & sustainable. Telecom service tax regulation for Wi-Fi services need to be reviewed for necessary amendment.
- Viability gap funding & transparent bidding process for selection of competent ISPs for deployment of Wi-Fi network through PPP mode.
- Finalizing realistic approach of MSAs / SLAs for Win-Win situation. Institutional Framework::clear cut Administrative & Organization Reforms at State / District/ Block/ Panchayat level.
- Direct involvement of Panchayats as one of the stakeholders for Commercial model as well as revenue sharing Business model. Public-Private-Panchayat Partnership-PPPP for Commercial model & Public-Private-Panchayat-People Partnership-PPPP for Business model. Here, people mean the small local entrepreneurs like CSC VLEs.
- Need to develop Neutral Hotspot with multiple SSIDs for addressing the issue of Quality-Divide.
- 2x2 Policy framework also needs to be addressed to have a balanced spectrum of Cost Vs Demand

flow under different market conditions like-(A) Market bottlenecks (low-cost/low demand), (B) Digital divide (high cost/low demand), (C) Tragedy of the commons (low cost/high demand), (D) Market power (high cost/high demand) etc.

- Unbundling models to be evolved for reduced transactional costs per mega byte.
- Commercial models leverage the uniqueness of Wi-Fi capabilities.
- For mobile data offload (MDO), standard SLAs need to be worked out for quick adoption by TSPs & ISPs.
- Cash based economy, electronic payments of small amounts and ease of use are still some challenges against monetization span, hence, these need to be properly addressed for wider penetration to the Indian society.
- Need to develop centralized switching grid & billing Hub(s) for subscribers' mobility management (for data) and aggregated payment platform (secured & robust). Proposed SPV may look after O&M of this Hub(s). To avoid variation in charging & billing, Uniform data plans need to be devised for the subscribed users intended to get the facility of both technological platforms (mobile & Wi-Fi). For this, the most viable case may appear when existing TSPs offering mobile services shall participate as Wi-Fi service enablers.
- Establishing Institutional Framework for collaborative action under clear cut Administrative & Organization Reforms at State / District/ Panchayat level, as it should be a Mission Mode Project (MMP).
- Requires most competitive but uniform pricing for both the consumers & other stakeholders. Equitable revenue sharing. Proposing 80/20 revenue sharing on the commission earned between local entrepreneurs & other stakeholders, in case, pre-defined targets are met.
- Creating a Special Purpose Vehicle (like BBNL, CSC SPV) for regular assessments on implementation, monitoring, providing supports at technical & financial capabilities etc. even after Government supports end. Need to review the roles of existing SPVs for incorporating these new activities.
- Constituting State/UT level Apex body comprising members from all the associated organizations / civic bodies for handholding & directing ISPs for smooth implementation of Wi-Fi network and to take the ownership of the model after it becomes fully functional till the last mile.

5. Deployment of Business models

For adopting viable business models for public Wi-Fi network proliferation, following features need to be followed:

- Identifying the local entrepreneurs (say CSC VLEs) well capable in delivering various eServices through ICT enabled kiosks. They can be entrusted to look after the maintenance of Wi-Fi access points and scaling up the distribution of Wi-Fi services to different categories of users (domestic / commercial / educational / industrial) as per tariff plans. Rents can be compensated in various ways. Access points O&M cost should be appropriately compensated by provisioning free Wi-Fi access to those VLEs for running his/her kiosk operations in delivering various services like G2C, B2C, e-Banking, Telemedicine, digital literacy mission etc.. Based on the categories of eServices & their volumes of transactions, suitable revenue sharing business models can also be derived at GP level. As current model of CSC scheme at GP level (now renamed as Digital Seva Kendra) under Digital India is based on 80/20 revenue sharing mechanism on the commission earned, the concerned State Government must take the calls at Apex level for deciding a balanced methodology of revenue sharing linked to utilization of connectivity on various eServices. Such Business models can also be designed based on the various popular models used for the provision of Internet access through public Wi-Fi networks such as Paid Model, Freemium model, Advertisement-based model, Aggregators model etc. This policy document suggests to deploy these models as per the geographic nature of the places as well as consumers' behaviours & needs.
- Advertisement based model may be the most useful model in village areas, as the Government and many non-government organizations are conducting various awareness creation programme in rural India through advertisements for bringing them into the mainstream of human development by education, skills & self-employments etc.
- Paid Model or Freemium model are generally applicable for urban areas.
- For availing the Wi-Fi facility anywhere in the country especially by those citizens who need to move around on regular basis, Aggregators model would be the most appropriate one. Normally, it is applicable for business oriented people in the City areas.
- Currently, the CSC platform is managed by CSC Special Purpose Vehicle (CSC SPV) which is basically a national level service aggregator and content & application provider. On the other hand, it has already taken an active initiative towards developing a **Rural Wi-Fi infrastructure** & hoist of suitable applications enabling and empowering it towards a "Smart

village". In this pursuit, CSC SPV has got Unified License (CAT A) for ISP and for instance, it has recently extended the bandwidth of BharatNet up to the last mile through Wi-Fi solutions at around 600 villages across the country. **So, the instant proposed Policy recommends to develop similar solution across the nation that is believed to be taken very quickly to the villages and implemented.** The design Goal should be to achieve the lowest cost for the Communications infrastructure whilst fulfilling the requirements of the applications in terms of performance. **A Proof of Concept (PoC) should be worked out to arrive upon a standard set of equipments & lesser deployment cost that can then be replicated across all the villages activated under the NOFN/BharatNet project**. Digital Seva Kendras (CSCs) should be made capable to maintain Outdoor Wi-Fi Access Points (OPAPs) and facilitate distribution of Wi-Fi connectivity to the customer near their place of residence. This will lead to a true digital empowerment of the rural populace including the young and aspiring youth of emergent India.

6. Conclusions

To make such initiative of leveraging CSC for public Wi-Fi more robust in the broader spectrum, Government needs to develop a National level integrated structure of Wi-Fi network with various technological aspects including provision of sharing the same by multiple ISPs. Such unified aggregated platform needs to be featured with secured Payment Interface approved by RBI with options of registration open for all ISPs. CSC SPV being a national level aggregator of eServices already obtained in principal approval from Reserve Bank of India (RBI) for functioning as nation-wide Bill Payment Operating Unit (BPOU). BBPOU system to be integrated with Unified Payment Interface (UPI) of National Payment Corporation of India (NPCI) is a bill payment system in India with a single point providing 'anytime anywhere payment system' to customer. BBPOU shall help CSCs become ubiquitous service points for all consumers & make them accountable too. Such Bill Payment Services (BBPS) activity can facilitate the collection of repetitive payment of everyday utility services such as Wi-Fi bills-

"pay-as-you-go basis or post-paid basis & many others.